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13. ABSTRACT (Maximum 200 words)

Over the past year, we have concentrated on analysis of FMCW radar data obtained during the CASES'99 experiment. Collected data have been quality controlled and processed to 5 second averaged profiles. Both radar images (GIFs) and data (NetCDF format) were provided to the NCAR JOSS data archive in May 2000. Since then, we have been working with other CASES investigators in studying particular events in various IOPs. Preliminary results were reported in two conferences, IGARSS 2000 and the AMS Boundary Layers and Turbulence Symposium. We are currently coauthoring two manuscripts with other CASES investigators that will be submitted for publication in 2001.

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Sincerely,

Stephen J. Frasier
Principal Investigator

ARO Grant DAAG-55-98-1-0513:
"High Resolution S-Band Profiling of the Atmospheric Boundary Layer"

Third Interim Report: CY 2000

1 List of Manuscripts

Ince, T., A.L. Pazmany, S.J. Frasier, "High resolution Profiling of the Atmospheric Boundary Layer", *2000 International Geoscience and Remote Sensing Symposium (IGARSS'2000)*, Honolulu, Hawaii, July, 2000, IEEE.

Ince, T., J. Li, F.J. Lopez-Dekker, A.L. Pazmany, S.J. Frasier, "Radar Observations of the Stable Boundary Layer During CASES'99", 14th Symposium on Boundary Layers and Turbulence", Snowmass, CO, Aug 2000, American Meteorological Society, pp. 355-357.

2 Scientific Personnel

1. Stephen J. Frasier, Principal Investigator
2. Andrew L. Pazmany, Research Assoc. Professor
3. Turker Ince, Graduate Student

3 Report of Inventions

None.

4 Scientific Progress and Accomplishments

4.1 Scientific Objectives

The overall objective of our research program is to obtain a better understanding of the fine-scale structure of the ABL through the use of high-resolution radar techniques.

4.2 Approach

Our approach has been to (1) build, test, and evaluate the operation of an S-band FMCW radar for high-resolution profiling of the ABL, (2) participate in a joint field experiment with the Turbulent Eddy Profiler (TEP) radar and other research instrumentation, and (3) compare S-band measurements with simultaneous UHF measurements and interpret results with respect to grid-scale vs. subgrid-scale turbulence and intermittency.

4.3 Tasks Completed

Over the past year, we have concentrated on analysis of FMCW radar data obtained during the CASES'99 experiment. Collected data have been quality controlled and processed to 5 second averaged profiles. Both radar images (GIFs) and data (NetCDF format) were provided to the NCAR JOSS data archive in May 2000. Since then, we have been working with other CASES investigators in studying particular events in various IOPs. Preliminary results were reported in two conferences, IGARSS 2000 and the AMS Boundary Layers and Turbulence Symposium. We are currently coauthoring two manuscripts with other CASES investigators that will be submitted for publication in 2001.

4.4 Scientific Results

Figure 1 shows the decaying convective boundary layer and evening transition observed on October 19, 1999. The residual layer and two elevated layers are easily observable. The texture of the CBL scattering is indicative of strong insect scatter embedded within Bragg scattering from refractive index fluctuations. After dusk ($T \approx 150$ min) insect activity recurs, enhancing the scattering from the residual layer.

Figure 2 shows activity observed in the nocturnal boundary layer during the evening of October 26-27, 1999. The upper panel shows a K-H billow that formed in the residual layer

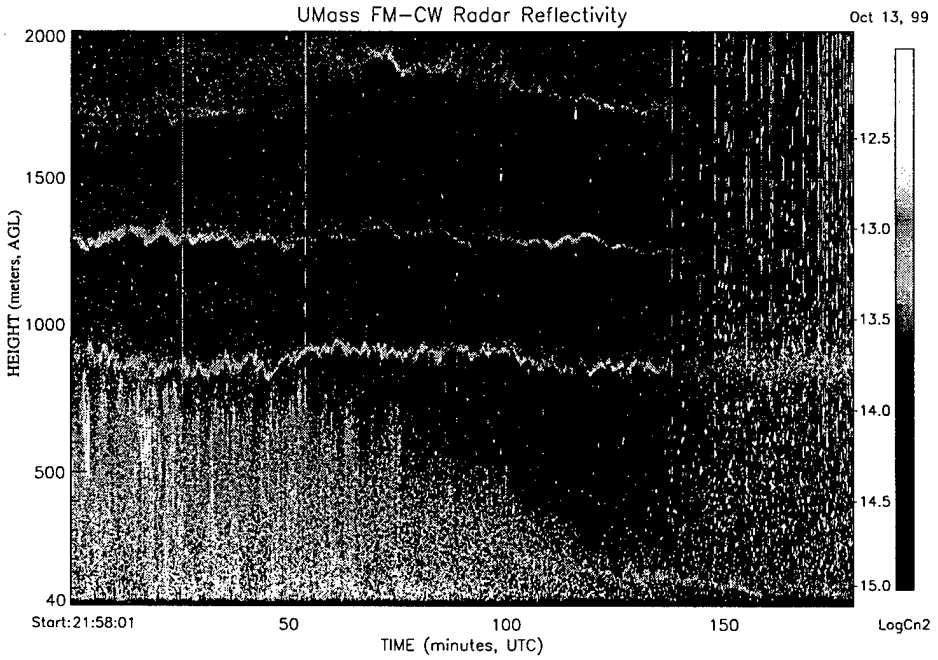

Figure 1: Evening transition observed on October 19, 1999. Local time is UTC - 5 hours.

at approximately 8:30 pm. The lower panel shows the onset of ground-based turbulence driven by a low-level jet that formed at approximately 2 am. Both images also show discrete echoes from insects.

We have spent some effort on the classification of radar echoes to assess the impact of insect scatter on clear-air returns. In particular, we have applied an adaptive median filter technique to radar images to separate Bragg- and Rayleigh-type echoes. The performance of the filter is demonstrated in figure 3. We have found that in many cases, the presence of insect scatter does not significantly impact the mean vertical profiles of C_n^2 in the convective BL. It does, of course, impact the pdf of "apparent C_n^2". This is a topic that we are working with Andreas Muschinski (NOAA/ETL) in assessing.

5 Technology Transfer

None.

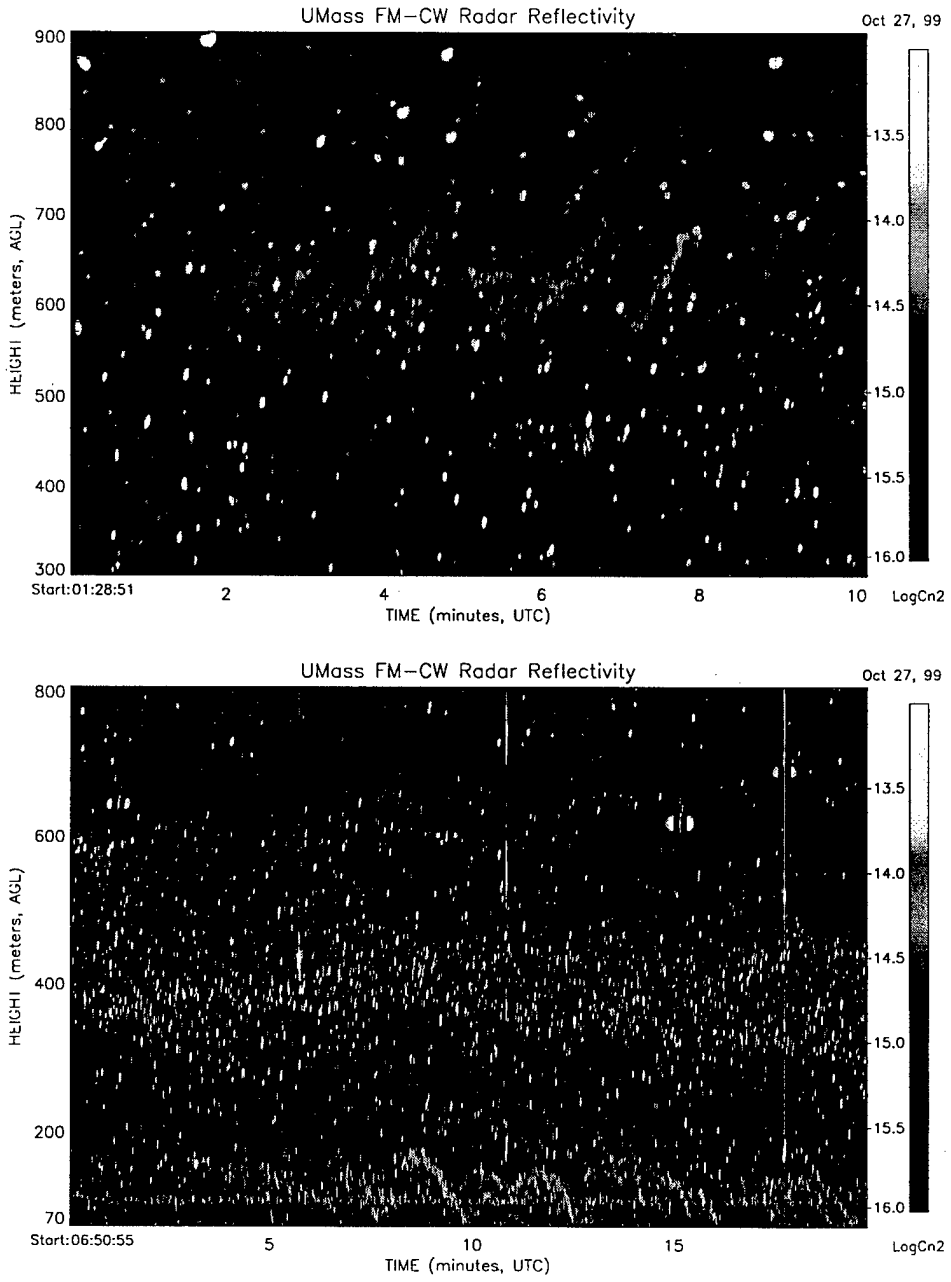

Figure 2: Top: Kelvin-Helmholtz billows observed in the residual layer in the evening of October 26, 1999. Bottom: Shear-induced turbulence driven by a low-level jet (confirmed by radiosonde) that developed above 200 m later in the evening.

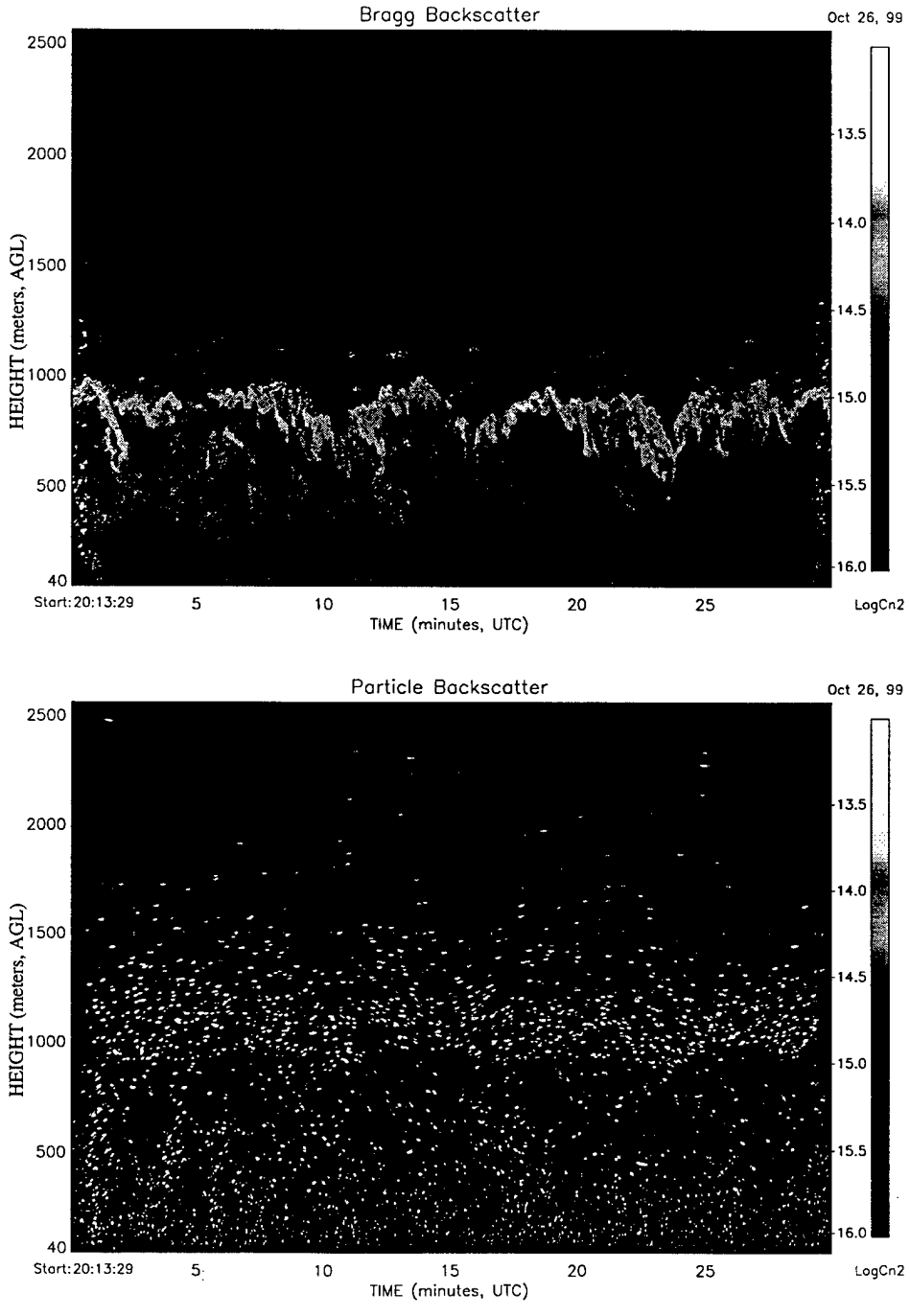

Figure 3: Adaptive median filter separation of boundary layer radar echo into Bragg-dominated (top) and Rayleigh-dominated (bottom) components.